EST™

BACKGROUNDER

alarm system survivability

a life safety white paper

EST BRAND LIFE SAFETY & COMMUNICATIONS FROM EDWARDS

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The only effective way to lower the risk to critical control equipment is to distribute it throughout the building.

The attacks in New York on September 11, 2001 bring into sharp focus the importance of having secure buildings that respond appropriately and effectively in the wake of threats and disasters of every kind. Emergency evacuation systems that merely report what is happening are simply not enough when there is sudden and extreme danger to building occupants. Today, these systems must orchestrate rapid evacuations, and above all, they must continue to operate effectively – especially in the face of catastrophic events.

One only has to look back at the first World Trade Center attack for evidence of how essential system survivability is. On February 26, 1993 at 12:18pm a bomb exploded in a parking garage under the center. Six people were killed immediately by the blast. By the time firefighters arrived on the scene minutes after the explosion, the largest building evacuation in history was already underway. Estimates at the time placed 150,000 people inside the seven-building complex that day, and as thousands of occupants inched their way down the darkened stairwells to safety, they confronted thick smoke rising up the building from the intense fire triggered by the bomb.

The force of the blast destroyed much of the building's electrical capacity. Power for emergency lighting was automatically transferred to backup systems. But the demand for electricity was so great that the diesel-powered generators soon overheated. One hour and fifteen minutes after the explosion, the World Trade Center went dark as the last of its massive generators shut down. Meanwhile, tens of thousands of people continued to pour down the now dark, smoke-filled stairwells. So many, in fact, that fire doors throughout the complex were held open for hours during the evacuation. As response teams battled the blaze in the basement, the stack effect caused by air currents rising up the stairwells and through open fire doors grew in strength.

Staged evacuation lessens the toll

Had it been possible for response personnel to communicate with building occupants, they would have orchestrated the evacuation so that the fire doors remained effective. They would have managed a staged evacuation, moving people to safety in order of their proximity to immediate danger. They would have instructed much of the population to stand by for instructions. But none of that was possible – the blast destroyed the fire alarm master control panel, severing all communications between rescue workers and building occupants. There was little response personnel could do except provide medical assistance as choking people in their hundreds streamed out of the burning building onto New York streets.

In the wake of the of the 1993 World Trade Center bombing, attention focused with renewed intensity on fire alarm system survivability. It came to light that the World Trade Center's fire alarm system was an aging master/slave arrangement that concentrated all the processing and control for the entire complex in one control panel. Once that control panel was disabled, no communication was possible between any connected equipment.

Your building doesn't have to be a World Trade Center to merit concern over emergency evacuation system survivability. Experts agree that any building with an emergency warning system must have measures in place that reduce the risk of system failure at the crucial moment. While terrorist attack is a threat many building owners are now taking seriously, there are more mundane and far more common threats that can compromise the integrity of fire alarm systems. Fires, construction and renovation work, earthquakes, gas line explosions, and even common electrical power interruptions will disrupt emergency communications in a small building just as effectively as a bomb in a large one.

Nonetheless, the lessons learned from the 1993 World Trade Center explosion have not been ignored. Today, evacuation systems are built to withstand the most tortuous conditions. Codes and standards in place around the world specify minimum levels of service a fire alarm system must provide in the event of a catastrophic system failure. New technology has kept pace with these requirements, delivering to market innovations and breakthroughs that enable emergency evacuation systems to continue operations under conditions much worse than those experienced during the 1993 World Trade Center bombing. Nonetheless, not all systems are equally survivable.

> System survivability is paramount to effective emergency evacuation. But some systems are more survivable than others. What characteristics distinguish one that will continue to operate during a catastrophe from one that will end up on the casualty list?

Two different approaches

In February 1996, nearly three years to the day after the first World Trade Center bombing, a powerful explosion ripped through London's Canary Wharf office and shopping center. The complex was served by two separate fire alarm systems that took different approaches to survivability. Both systems met government requirements. Both featured technology developed since the 1993 World Trade Center bombing. Both sustained comparable damage as a result of the blast. But only one emergency evacuation system survived.

Redundancy the key to survivability

System redundancy is the key to system survivability – it's what worked at Canary Wharf. Experts agree that the only effective way to lower the risk to critical control equipment is to distribute it throughout the installation, and build in redundancy to ensure that the system will continue to operate even if part of it has sustained heavy damage.

Edwards has accomplished this redundancy by designing networked evacuation systems that operate across peer-to-peer networks. Unlike master/slave configurations, such as the one in place at the World Trade Center in 1993, peer-to-peer networks don't rely on any single control panel for emergency annunciation or communication. Instead, each fire alarm control panel, known as a network node, serves a different part of the building. But at the same time, all the nodes communicate with each other so that control over the entire installation can be achieved from any control panel on the network.

This means that if one node is knocked out of commission, the others not only continue to provide life safety protection, they also provide a means of controlling evacuation signals and voice annunciation in any area served by the nodes that remain on-line. This arrangement provides a high degree of system survivability. It allows emergency personnel to manage response and evacuation from anywhere on the system. It also provides firefighters with the flexibility to operate more efficiently and more safely because they can establish control from a point away from danger, but central enough to work efficiently during the crisis.

Peer-to-peer networks are also very resilient when a break occurs in field wiring. For maximum survivability, control panels are typically wired in a loop, so that should a break occur, communications is automatically re-routed over alternate wiring paths. Similarly, when a control panel experiences an electrical failure, communications are automatically patched through the affected panel to unaffected connected nodes. And if a panel is isolated from the network by a break in the communications wiring, it continues to operate as a stand-alone system, providing detection and notification, even drawing its power from local standby batteries if necessary.

But today system survivability must go even further. At Edwards, the company that pioneered fire alarm peer-to-peer networking over a decade ago, engineers have built fail-safe features into the control panels themselves by developing network nodes that will continue to function even when crippled by a major failure of the central processing unit (CPU).

This second layer of survivability permits a control panel that has lost communications – or even the capacity to process information at its central processing unit – to continue to provide enough information to activate connected modules during an alarm condition. As a result, signals will sound, doors will unlock, vents will operate, and audio communication will be maintained in areas of a building served by a control panel that has suffered a major CPU meltdown.

Backup equipment reduces risk

Emergency notification lies at the very heart of every evacuation strategy. If notification fails, so does the evacuation effort. Edwards recognizes this and has developed the means to distribute backup equipment across their audio subsystems, as well as their control panels. For example, the powerful EST3 fire and security control platform features audio amplifiers that are intended to be distributed throughout the building. This provides an added measure of redundancy in case of failure.

Even if an amplifier should fail, EST3 backup amplifiers step in to maintain voice communications capabilities – a crucial means of getting people out of a building alive. If the backup amplifier fails, a built-in tone generator on the audio panel begins signalling alarm tones over its connected speakers. This, along with redundancy at the network level, gives some audio systems no less than four layers of protection.

It's not overkill either. This degree of redundancy is critical for emergency evacuation in large buildings. Voice communication is now the preferred method for providing instructions to building occupants. It is vital to every rescue effort. If firefighters don't have the ability to communicate with building occupants, the results can be disastrous.

But even among peer-to-peer networks, not all systems are created equal. True peer-to-peer networking provides global annunciation at any network node. This is a very important feature that not all systems on the market offer. A control panel or annunciator only reporting events for part of a building isn't doing its job. A little bit of knowledge can be a dangerous thing. Without being able to see the big picture, firefighters can easily direct an evacuation directly into the path of danger, instead of away from it. That's what happened at Dusseldorf Airport in 1996 when sixteen people died because during an evacuation they were mistakenly directed into an area filled with toxic smoke.

System survivability is paramount to effective emergency evacuation. It's a fact that is not lost on Edwards. We've been in the survivability business for more than 130 years.

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